

# **APPENDICES**



# **APPENDIX A**

## Appendix A

# GUIDE TO CONTAMINANTS FOUND AT TYPICAL BROWNFIELDS SITES

The following table identifies several activities that may have caused contamination at Brownfields sites. The table summarizes contaminants that are related to such activities and identifies sources for the contaminants; however, it is not an exhaustive list of contaminants that can be found at a Brownfields site. Identifying contaminants that may be present should be determined on a site-by-site basis. Such a determination should be conducted thoroughly and carefully. Information for this table was compiled from several sources, including various EPA *Guides to Pollution Prevention* for selected industries. A list of the specific citations used is provided on page A-2.

Past Activities Typically Conducted at Brownfields Sites	Typical Contaminants and Typical Sources
Agriculture	Volatile organic compounds (VOC); arsenic, copper, carbon tetrachloride, ethylene dibromide, and methylene chloride; pesticides; insecticides; herbicides; grain fumigants
Automotive refinishing and repair	Some metals and metal dust; various organic compounds; solvents; paint and paint sludges; scrap metal; waste oils
Battery recycling and disposal	Lead; cadmium; acids
Chloro-alkali manufacturing	Chlorine compounds; mercury
Coal gasification	Polynuclear aromatic hydrocarbons (PAH)
Cosmetics manufacturing	Heavy metals; dusts; solvents; acids
Dry cleaning activities	VOCs such as chloroform and tetrachloroethane; various solvents; spot removers; fluorocarbon 113
Electroplating operations	Various metals such as cadmium, chromium, cyanide, copper, and nickel
Glass manufacturing	Arsenic; lead
Herbicide manufacturing and use	Dioxin; metals; herbicides
Hospitals	Formaldehyde; radionuclides; photographic chemicals; solvents; mercury; ethylene oxide; chemotherapy chemicals
Incinerators	Dioxin; various municipal and industrial waste
Landfills—municipal and industrial	Metals; VOCs; polychlorinated biphenyl (PCB); ammonia; methane; household products and cleaners; pesticides; various wastes
Leather manufacturing	Toluene; benzene
Machine shops/metal fabrication	Metals; VOCs; dioxin; beryllium; degreasing agents; solvents; waste oils
Marine maintenance industry	Solvents; paints; cyanide; acids; VOC emissions; heavy metal sludges; degreasers
Munitions manufacturing	Lead; explosives; copper; antimony
Paint/ink manufacturing	Metals (such as chromium, cadmium, lead, and zinc); VOCs; chloroform; ethyl benzene; solvents; paints; inks
Pesticide manufacturing	VOCs; arsenic; copper; pesticides; insecticides; herbicides; fungicides; xylene; chlorinated organic compounds; solvents
Petroleum refining and reuse	Petroleum hydrocarbons; benzene, toluene, ethylbenzene, xylene (BTEX); fuels; oil and grease
Pharmaceutical manufacturing	Lead; various organic chemicals; organic solvents
Photographic manufacturing and uses	Silver bromide; methylene chloride; solvents; photographic products
Plastics manufacturing	Polymers; phthalates; cadmium; solvents; resins; chemical additives; VOCs

Past Activities Typically Conducted at Brownfields Sites (continued)	Typical Contaminants and Typical Sources
Printing industry	Silver; solvents; acids; waste oils; inks and dyes; photographic chemicals
Railroad yards	Petroleum hydrocarbons; VOCs; BTEX; solvents; fuels; oil and grease; lead; PCBs
Research and educational institutions	Inorganic acids; organic solvents; metals and metal dust; photographic waste; waste oil; paint; heavy metals; pesticides
Scrap metal operations	Various metals (such as lead and nickel); PCBs; dioxin; transformers
Smelter operations	Metals (such as lead, copper, and arsenic)
Semiconductor manufacturing	Metals; VOCs; carbon tetrachloride; degreasing agents; solvents
Wood pulp and paper manufacturing	Chlorinated organic compounds; dioxin; furans; chloroform; resin acids
Wood preserving	Creosote; pentachlorophenol (PCP); arsenic; chromium; copper; PCB; PAHs; beryllium; dioxin; wood preservatives

### LIST OF CITATIONS USED TO IDENTIFY COMMON CONTAMINANTS

- Contaminants and Remedial Options at Selected Metal-Contaminated Sites (EPA 540-R-95-512, PB95-271961)
  - *The Mechanical Equipment Repair Industry* (EPA 625-R-92-008)
  - *The Pesticide Formulating Industry* (EPA 625-7-90-004)
  - *The Pharmaceutical Industry* (EPA 625-7-91-017)
- Dry Cleaning and Laundry Plants, Fact Sheet (EPA 530-SW-90-027b)
- Guidelines for Waste Reduction and Recycling: Metal Finishing, Electroplating, Printed Circuit Board Manufacturing, Hazardous Waste Reduction Program, Oregon Department of Environmental Quality (No document number)
- Guides to Pollution Prevention:
  - *Research and Educational Institutions* (EPA 625-7-90-010)
  - *Selected Hospital Waste Streams* (EPA 625-7-90-009)
  - *The Automotive Refinishing Industry* (EPA 625-7-91-016)
  - *The Automotive Repair Industry* (EPA 625-7-91-013)
  - *The Commercial Printing Industry* (EPA 625-7-90-008)
  - *The Fiberglass-Reinforced and Composite Plastics Industry* (EPA 625-7-91-014)
  - *The Marine Maintenance and Repair Industry* (EPA 625-7-91-015)
- Innovative Treatment Technologies: Annual Status Report (EPA 542-R-95-008)
- Low-Level Mixed Waste: A RCRA Perspective for NRC Licenses (EPA 530-SW-90-057)
- Pollution Prevention Technologies for the Bleached Kraft Segment of the U.S. Pulp and Paper Industry (EPA 600-R-93-110)
- Solving the Hazardous Waste Problem: EPA's RCRA Program (EPA 530-SW-86-037)
- Waste Minimization Audit Report: Case Studies of Minimization of Mercury-Bearing Wastes at a Mercury Cell Chloralkali Plant: Project Summary (EPA 600-S2-88-011)
- Waste Minimization Opportunity Assessment: Philadelphia Naval Shipyard: Project Summary (EPA 600-S2-90-046)
- Waste Reduction for the Aerospace Industry: Fact Sheet, California Department of Health Services Technology Clearinghouse (no document number)

# **APPENDIX B**



# Remediation Technologies Screening Matrix

NOTE: Specific site and contaminant characteristics may limit the applicability and effectiveness of any of the technologies and treatments listed below. This matrix is optimistic in nature and should always be used in conjunction with the referenced text sections, which contain additional information that can be useful in identifying potentially applicable technologies.

	Development Status	Availability	Residuals Produced	Treatment Train (excludes oil-gas treatment)	Contaminants Treated					System Reliability/Maintainability	Cleanup Time	Overall Cost	O&M or Capital Intensive
					VOCs	SVOCs	Fuels	Inorganic	Explosives				
SOIL, SEDIMENT, AND SLUDGE													
3.1 In Situ Biological Treatment													
4.1 Biodegradation	Full	■	None	No	■	■	■	△	■	△	○	■	O&M
4.2 Bioventing	Full	■	None	No	■	■	■	△	■	○	■	■	Neither
4.3 White Rot Fungus	Pilot	△	None	No	△	△	△	△	■	△	○	■	O&M
3.2 In Situ Physical/Chemical Treatment													
4.4 Pneumatic Fracturing (enhancement)	Pilot	△	None	Yes	○	○	○	○	○	■	NA	■	Neither
4.5 Soil Flushing	Pilot	■	Liquid	No	■	○	○	△	△	○	△	■	O&M
4.6 Soil Vapor Extraction (In Situ)	Full	■	Liquid	No	■	○	■	△	△	■	○	■	O&M
4.7 Solidification/Stabilization	Full	■	Solid	No	△	○	△	■	■	■	■	■	CAP
3.3 In Situ Thermal Treatment													
4.8 Thermally Enhanced SVT	Full	○	Liquid	No	○	■	○	△	△	○	■	○	Both
4.9 Vitrification	Pilot	△	Liquid	No	○	○	○	■	△	△	■	△	Both
3.4 Ex Situ Biological Treatment (assuming excavation)													
4.10 Composting	Full	■	None	No	■	○	■	△	■	○	■	■	Neither
4.11 Controlled Solid Phase Bio. Treatment	Full	■	None	No	■	○	■	△	■	○	■	■	Neither
4.12 Landfarming	Full	■	None	No	■	○	■	△	○	△	■	■	Neither
4.13 Slurry Phase Bio. Treatment	Full	○	None	No	■	○	■	△	○	○	○	■	Both
3.5 Ex Situ Physical/Chemical Treatment (assuming excavation)													
4.14 Chemical Reduction/Oxidation	Full	■	Solid	Yes	○	○	○	■	△	■	○	■	Neither
4.15 Dehalogenation (BCD)	Full	△	Vapor	No	○	■	△	△	△	■	■	■	I
4.16 Dehalogenation (Glycolate)	Full	○	Liquid	No	○	■	△	△	△	■	△	△	Both
4.17 Soil Washing	Full	○	Solid, Liquid	Yes	○	■	■	■	■	△	○	○	Both
4.18 Soil Vapor Extraction (Ex Situ)	Full	■	Liquid	No	■	○	○	△	△	■	○	■	Neither
4.19 Solidification/Stabilization	Full	■	Solid	No	△	○	△	■	△	■	■	■	CAP
4.20 Solvent Extraction (chemical extraction)	Full	○	Liquid	Yes	○	■	○	■	○	△	△	■	Both
3.6 Ex Situ Thermal Treatment (assuming excavation)													
4.21 High Temperature Thermal Desorption	Full	■	Liquid	Yes	○	■	○	△	△	○	■	○	Both
4.22 Hot Gas Decontamination	Pilot	○	None	No	△	△	△	△	■	■	■	■	Both
4.23 Incineration	Full	■	Liquid, Solid	No	○	■	■	△	○	■	■	△	Both
4.24 Low Temperature Thermal Desorption	Full	■	Liquid	Yes	■	○	■	△	○	■	■	■	Both
4.25 Open Burn/Open Detonation	Full	■	Solid	No	△	△	△	△	■	■	■	■	Both
4.26 Pyrolysis	Full	△	Liquid, Solid	No	○	■	○	△	■	■	△	■	Both
4.27 Vitrification	Full	○	Liquid	No	○	○	○	■	○	○	○	△	Both
3.7 Other Treatment													
4.28 Excavation, Retrieval, and Off-Site Disposal	NA	■	NA	No	○	○	○	○	○	■	■	△	Neither
4.29 Natural Attenuation	NA	■	None	No	■	■	■	△	△	■	■	■	Neither

Rating Codes (See Table 3-1)

■ Better

## Rating Codes (See Table 3-1)

■ Better

○ Average

△ Worse

I Inadequate Information

NA Not Applicable

Source: Remediation Technologies Screening Matrix and Reference Guide (PB95-104782)



GROUNDWATER, SURFACE WATER, AND LEACHATE

3.8 In Situ Biological Treatment													
4.30 Co-metabolic Treatment	Pilot	△	None	No	■	■	⊗	△	⊗	△	⊗	⊗	O&M
4.31 Nitrate Enhancement	Pilot	△	None	No	■	■	■	△	⊗	⊗	⊗	■	Neither
4.32 Oxygen Enhancement with Air Sparging	Full	■	None	No	■	■	■	△	⊗	⊗	⊗	■	Neither
4.33 Oxygen Enhancement with H <sub>2</sub> O <sub>2</sub>	Full	■	None	No	■	■	■	△	⊗	⊗	⊗	■	O&M
3.9 In Situ Physical/Chemical Treatment													
4.34 Air Sparging	Full	■	Vapor	Yes	■	△	■	△	△	■	■	■	Neither
4.35 Directional Wells (enhancement)	Full	△	NA	Yes	⊗	⊗	⊗	⊗	⊗	⊗	■	I	Neither
4.36 Dual Phase Extraction	Full	■	Liquid,Vapor	Yes	■	△	■	△	△	⊗	⊗	⊗	O&M
4.37 Free Product Recovery	Full	■	Liquid	No	■	■	■	△	△	⊗	⊗	⊗	Neither
4.38 Hot Water or Steam Flushing/Stripping	Pilot	⊗	Liquid,Vapor	Yes	⊗	■	■	△	△	⊗	■	⊗	CAP
4.39 Hydrofracturing (enhancement)	Pilot	I	None	Yes	⊗	⊗	⊗	⊗	⊗	■	■	⊗	Neither
4.40 Passive Treatment Walls	Pilot	△	Solid	No	■	■	⊗	■	■	I	△	I	CAP
4.41 Slurry Walls (containment only)	Full	■	NA	NA	⊗	⊗	⊗	⊗	⊗	■	■	⊗	CAP
4.42 Vacuum Vapor Extraction	Pilot	△	Liquid,Vapor	No	■	⊗	■	■	I	△	⊗	⊗	CAP
3.10 Ex Situ Biological Treatment (assuming pumping)													
4.43 Bioreactors	Full	■	Solid	No	■	■	■	△	⊗	⊗	NA	■	CAP
3.11 Ex Situ Physical/Chemical Treatment (assuming pumping)													
4.44 Air Stripping	Full	■	Liquid,Vapor	No	■	⊗	⊗	△	△	■	NA	■	O&M
4.45 Filtration	Full	■	Solid	Yes	△	△	△	■	⊗	■	⊗	■	Neither
4.46 Ion Exchange	Full	■	Solid	Yes	■	■	⊗	■	■	■	NA	■	Neither
4.47 Liquid Phase Carbon Adsorption	Full	■	Solid	No	■	■	⊗	⊗	■	I	⊗	■	O&M
4.48 Precipitation	Full	■	Solid	Yes	△	△	△	■	■	■	⊗	■	Neither
4.49 UV Oxidation	Full	■	None	No	■	■	■	■	■	■	NA	⊗	Both
3.12 Other Treatment													
4.50 Natural Attenuation	NA	■	None	No	■	■	■	△	△	■	△	■	Neither
3.13 AIR EMISSIONS/OFF-GAS TREATMENT													
4.51 Biofiltration	Full	⊗	None	NA	■	⊗	■	△	⊗	△	NA	⊗	Neither
4.52 High Energy Corona	Pilot	△	None	NA	■	■	■	⊗	△	△	NA	⊗	I
4.53 Membrane Separation	Pilot	△	None	NA	■	⊗	⊗	⊗	⊗	△	NA	⊗	I
4.54 Oxidation	Full	■	None	NA	■	■	■	△	⊗	■	NA	■	Neither
4.55 Vapor Phase Carbon Adsorption	Full	■	Solid	NA	■	■	■	⊗	■	■	NA	■	Neither

■ Better  
 ○ Average  
 △ Worse

I Inadequate Information  
NA Not Applicable

---

# **APPENDIX C**



## Appendix C

# LIST OF ACRONYMS and GLOSSARY OF KEY TERMS

<b>ARAR</b>	Applicable or Relevant and Appropriate Requirement	<b>NRC</b>	National Response Center
<b>ASTM</b>	American Society for Testing and Materials	<b>O &amp; M</b>	Operations and Maintenance
<b>BDAT</b>	Best Demonstrated Achievable Technology	<b>ORD</b>	Office of Research and Development
<b>BTEX</b>	Benzene, Toluene, Ethylbenzene, and Xylene	<b>OSWER</b>	Office of Solid Waste and Emergency Response
<b>CAA</b>	Clean Air Act	<b>PAH</b>	Polynuclear Aromatic Hydrocarbon
<b>CERCLA</b>	Comprehensive Environmental Response, Compensation, and Liability Act	<b>PA/SI</b>	Preliminary Assessment and Site Inspection
<b>CERCLIS</b>	Comprehensive Environmental Response, Compensation, and Liability Information System	<b>PCB</b>	Polychlorinated Biphenyl
<b>CWA</b>	Clean Water Act	<b>PCP</b>	Pentachlorophenol
<b>DDT</b>	Dioxin	<b>PRP</b>	Potentially Responsible Party
<b>DNAPL</b>	Dense Nonaqueous Phase Liquid	<b>QA/QC</b>	Quality Assurance and Quality Control
<b>DQO</b>	Data Quality Objective	<b>RCRA</b>	Resource Conservation and Recovery Act
<b>EPA</b>	U.S. Environmental Protection Agency	<b>RD/RA</b>	Remedial Design and Remedial Action
<b>ESA</b>	Environmental Site Assessment	<b>RI/FS</b>	Remedial Investigation and Feasibility Study
<b>HRS</b>	Hazard Ranking System	<b>ROD</b>	Record of Decision
<b>HSWA</b>	Hazardous and Solid Waste Amendments	<b>RQ</b>	Reportable quantity
<b>IRIS</b>	Integrated Risk Information System	<b>SARA</b>	Superfund Amendments and Reauthorization Act
<b>ITT</b>	Innovative Treatment Technology	<b>SITE</b>	Superfund Innovative Technology Evaluation Program
<b>LDR</b>	Land Disposal Restrictions	<b>SVE</b>	Soil Vapor Extraction
<b>LNAPL</b>	Light Nonaqueous Phase Liquid	<b>SVOC</b>	Semi-Volatile Organic Compound
<b>LUST</b>	Leaking Underground Storage Tank	<b>TCE</b>	Trichloroethylene
<b>NAPL</b>	Nonaqueous Phase Liquid	<b>TIO</b>	Technology Innovation Office
<b>NCP</b>	National Contingency Plan	<b>TPH</b>	Total Petroleum Hydrocarbon
<b>NPDES</b>	National Pollutant Discharge Elimination System	<b>TSCA</b>	Toxic Substances Control Act
<b>NPL</b>	National Priorities List	<b>TSDF</b>	Treatment, Storage, and Disposal Facility
		<b>UST</b>	Underground Storage Tank
		<b>VCP</b>	Voluntary Cleanup Program
		<b>VOC</b>	Volatile Organic Compound

The following is a list of specialized terms used during the cleanup of Brownfields sites.

**Absorption**

Absorption is the passage of one substance into or through another.

**Adsorption**

Adsorption is the adhesion of molecules of gas, liquid, or dissolved solids to a surface. The term also refers to a method of treating wastes in which activated carbon removes organic matter from wastewater.

**Air Sparging**

In air sparging, air is injected into the ground below a contaminated area, forming bubbles that rise and carry trapped and dissolved contaminants to the surface where they are captured by a soil vapor extraction system. Air sparging may be a good choice of treatment technology at sites contaminated with solvents and other volatile organic compounds (VOC). *See also Soil Vapor Extraction and Volatile Organic Compound.*

**Air Stripping**

Air stripping is a treatment system that removes or "strips" VOCs from contaminated groundwater or surface water as air is forced through the water, causing the compounds to evaporate. *See also Volatile Organic Compound.*

**American Society for Testing and Materials (ASTM)**

The ASTM sets standards for many services, including methods of sampling and testing of hazardous waste and media contaminated with hazardous waste.

**Applicable or Relevant and Appropriate Requirement (ARAR)**

As defined under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), ARARs are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under Federal or state law that specifically address problems or situations present at a CERCLA site. ARARs are major considerations in setting cleanup goals, selecting a remedy, and determining how to implement that remedy at a CERCLA site. ARARs must be attained at all CERCLA sites unless a waiver is attained. ARARs

are not national cleanup standards for the Superfund program. *See also Comprehensive Environmental Response, Compensation, and Liability Act and Superfund.*

**Aquifer**

An aquifer is an underground rock formation composed of such materials as sand, soil, or gravel that can store groundwater and supply it to wells and springs.

**Aromatics**

Aromatics are organic compounds that contain 6-carbon ring structures, such as creosote, toluene, and phenol, that often are found at dry cleaning and electronic assembly sites.

**Baseline Risk Assessment**

A baseline risk assessment is an assessment conducted before cleanup activities begin at a site to identify and evaluate the threat to human health and the environment. After remediation has been completed, the information obtained during a baseline risk assessment can be used to determine whether the cleanup levels were reached.

**Bedrock**

Bedrock is the rock that underlies the soil; it can be permeable or non-permeable. *See also Confining Layer and Creosote.*

**Best Demonstrated Achievable Technology (BDAT)**

A BDAT is a technology that has demonstrated the ability to reduce a particular contaminant to a lower concentration than other currently available technologies. BDATs can change with time as technologies evolve.

**Bioremediation**

Bioremediation refers to treatment processes that use microorganisms (usually naturally occurring) such as bacteria, yeast, or fungi to break down hazardous substances into less toxic or nontoxic substances. Bioremediation can be used to clean up contaminated soil and water. In situ bioremediation treats the contaminated soil or groundwater in the location in which it is found. For ex situ bioremediation processes, contaminated soil must be excavated or groundwater pumped before they can be treated.

**Biosensor**

A biosensor is a portable device that uses living organisms, such as enzymes, tissues, microbes, and antibodies, to produce reactions to analytes.

**Bioventing**

Bioventing is an in situ remediation technology that combines soil vapor extraction methods with bioremediation. It uses vapor extraction wells that induce air flow in the subsurface through air injection or through the use of a vacuum. Bioventing can be effective in remediating releases of petroleum products, such as gasoline, jet fuels, kerosene, and diesel fuel. *See also Bioremediation and Soil Vapor Extraction.*

**Borehole**

A borehole is a hole cut into the ground by means of a drilling rig.

**Borehole Geophysics**

Borehole geophysics are nuclear or electric technologies used to identify the physical characteristics of geologic formations that are intersected by a borehole.

**Brownfields**

Brownfields sites are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.

**BTEX**

BTEX is the term used for benzene, toluene, ethylbenzene, and xylene-volatile aromatic compounds typically found in petroleum products, such as gasoline and diesel fuel.

**Cadmium**

Cadmium is a heavy metal that accumulates in the environment. *See also Heavy Metal.*

**Carbon Adsorption**

Carbon adsorption is a treatment system that removes contaminants from groundwater or surface water as the water is forced through tanks containing activated carbon.

**Chemical Dehalogenation**

Chemical dehalogenation is a chemical process that removes halogens (usually chlorine) from a chemical contaminant, rendering the contaminant less hazardous. The chemical dehalogenation process can be applied to common halogenated contaminants such as polychlorinated biphenyls (PCB) and dioxins (DDT), which may be present in soil and oils. Dehalogenation can be effective in removing halogens from hazardous organic compounds, such as dioxins, PCBs, and certain chlorinated pesticides. The treatment time is short, energy requirements are moderate, and operation and maintenance costs are relatively low. This technology can be brought to the site, eliminating the need to transport hazardous wastes. *See also Polychlorinated Biphenyl and Dioxin.*

**Chlorinator**

A chlorinator is a device that adds chlorine, in gas or liquid form, to water or sewage to kill bacteria.

**Clean Air Act (CAA)**

The CAA is a Federal law passed in 1970 that requires the U.S. Environmental Protection Agency (EPA) to establish regulations to control the release of contaminants to the air to protect human health and environment.

**Cleanup**

Cleanup is the term used for actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and or the environment. The term sometimes is used interchangeably with the terms remedial action, removal action, response action, or corrective action.

**Clean Water Act (CWA)**

CWA is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to U.S. waters. This law gave EPA the authority to set effluent standards on an industry-by-industry basis and to set water quality standards for all contaminants in surface waters.

**Colorimetric**

Colorimetric refers to chemical reaction-based indicators that are used to produce compound reactions to individual compounds, or classes of compounds. The reactions, such as visible color changes or other easily noted indications, are used to detect and quantify contaminants.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**

CERCLA is a Federal law passed in 1980 that created a special tax that funds a trust fund, commonly known as Superfund, to be used to investigate and clean up abandoned or uncontrolled hazardous waste sites. CERCLA required for the first time that EPA step beyond its traditional regulatory role and provide response authority to clean up hazardous waste sites. EPA has primary responsibility for managing cleanup and enforcement activities authorized under CERCLA. Under the program, EPA can pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or take legal action to force parties responsible for contamination to clean up the site or reimburse the Federal government for the cost of the cleanup. *See also Superfund.*

**Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)**

CERCLIS is a database that serves as the official inventory of Superfund hazardous waste sites. CERCLIS also contains information about all aspects of hazardous waste sites, from initial discovery to deletion from the National Priorities List (NPL). The database also maintains information about planned and actual site activities and financial information entered by EPA regional offices. CERCLIS records the targets and accomplishments of the Superfund program and is used to report that information to the EPA Administrator, Congress, and the public. *See also National Priorities List and Superfund.*

**Confining Layer**

A "confining layer" is a geological formation characterized by low permeability that inhibits the flow of water. *See also Bedrock and Permeability.*

**Contaminant**

A contaminant is any physical, chemical, biological, or radiological substance or matter present in any media at concentrations that may result in adverse effects on air, water, or soil.

**Corrective Measure Study (CMS)**

If the potential need for corrective measures is verified during a RCRA Facility Investigation (RFI), the owner or operator of a facility is then responsible for performing a CMS. A CMS is conducted to identify, evaluate, and recommend specific corrective measures based on a detailed engineering evaluation. Using data collected during the RFI, the CMS demonstrates that proposed measures will be effective in controlling the source of contamination, as well as problems posed by the migration of substances from the original source into the environment. The measures also must be assessed in terms of technical feasibility, ability to meet public health protection requirements and protect the environment, possible adverse environmental effects, and institutional constraints. *See also RCRA Facility Investigation.*

**Corrosivity**

Corrosive wastes include those that are acidic and capable of corroding metal such as tanks, containers, drums, and barrels.

**Creosote**

Creosote is an oily liquid obtained by the distillation of wood that is used as a wood preservative and disinfectant and often is found at wood preserving sites. *See also Aromatics and Light Nonaqueous Phase Liquid.*

**Data Quality Objective (DQO)**

DQOs are qualitative and quantitative statements specified to ensure that data of known and appropriate quality are obtained. The DQO process is a series of planning steps, typically conducted during site assessment and investigation, that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate. The DQO process involves a logical, step-by-step procedure for determining which of the complex issues affecting a site are the most relevant to planning a site investigation before any data are collected.

**Dechlorination**

Dechlorination, the process used primarily to treat and destroy halogenated aromatic contaminants, is the chemical reaction that removes halogens (usually chlorine) from the primary structure of the contaminating organic chemical. Dechlorination can treat contaminated liquids, soils, sludges, and sediments, as well as halogenated organics and PCBs, pesticides, and some herbicides.

**Dense Nonaqueous Phase Liquid (DNAPL)**

A DNAPL is one of a group of organic substances that are relatively insoluble in water and more dense than water. DNAPLs tend to sink vertically through sand and gravel aquifers to the underlying layer.

**Dioxin (DDT)**

A dioxin is any of a family of compounds known chemically as dibenzo-p-dioxins. They are chemicals released during combustion. Concern about them arises from their potential toxicity and the risk posed by contamination in commercial products. Boilers and industrial furnaces are among the sources of dioxins.

**Disposal**

Disposal is the final placement or destruction of toxic, radioactive or other wastes; surplus or banned pesticides or other chemicals; polluted soils; and drums containing hazardous materials from removal actions or accidental release. Disposal may be accomplished through the use of approved secure landfills, surface impoundments, land farming, deep well injection, ocean dumping, or incineration.

**Dual-Phase Extraction**

Dual-phase extraction is a technology that extracts contaminants simultaneously from soils in saturated and unsaturated zones by applying soil vapor extraction techniques to contaminants trapped in saturated zone soils. *See also Soil Vapor Extraction.*

**Electromagnetic (EM) Geophysics**

EM geophysics refers to technologies used to detect spatial (lateral and vertical) differences in subsurface electromagnetic characteristics. The data collected provide information about subsurface environments.

**Electromagnetic (EM) Induction**

EM induction is a geophysical technology used to induce a magnetic field beneath the earth's surface, which in turn causes a secondary magnetic field to form around nearby objects that have conductive properties, such as ferrous and nonferrous metals. The secondary magnetic field is then used to detect and measure buried debris.

**Emergency Removal**

An emergency removal is an action initiated in response to a release of a hazardous substance that requires on-site activity within hours of a determination that action is appropriate.

**Emerging Technology**

An emerging technology is an innovative technology that currently is undergoing bench-scale testing. During bench-scale testing, a small version of the technology is built and tested in a laboratory. If the technology is successful during bench-scale testing, it is demonstrated on a small scale at field sites. If the technology is successful at the field demonstrations, it often will be used full scale at contaminated waste sites. As the technology is used and evaluated at different sites, it is improved continually. *See also Established Technology and Innovative Technology.*

**Enforcement Action**

An enforcement action is an action undertaken by EPA under its authority granted under various Federal environmental statutes, such as CERCLA, RCRA, CAA, CWA, the Toxic Substances Control Act (TSCA), and others. For example, under CERCLA, EPA may obtain voluntary settlement or compel potentially responsible parties (PRP) to implement removal or remedial actions when releases of hazardous substances have occurred. *See also Comprehensive Environmental Response, Compensation, and Liability Act, Potentially Responsible Party, and Removal Action.*

**Engineered Control**

An engineered control, such as barriers placed between contamination and the rest of a site, is a method of managing environmental and health risks. Engineered controls can be used to limit exposure pathways.



**Environmental Audit**

*See Phase I Environmental Audit.*

**Environmental Site Assessment (ESA)**

An ESA is the process by which it is determined whether contamination is present on a site.

**Established Technology**

An established technology is a technology for which cost and performance information is readily available. Only after a technology has been used at many different sites and the results fully documented is that technology considered established. The most frequently used established technologies are incineration, solidification and stabilization, and pump-and-treat technologies for groundwater. *See also Emerging Technology and Innovative Technology.*

**Exposure Pathway**

An exposure pathway is the route of contaminants from the source of contamination to potential contact with a medium (air, soil, surface water, or groundwater) that represents a potential threat to human health or the environment. Determining whether exposure pathways exist is an essential step in conducting a baseline risk assessment. *See also Baseline Risk Assessment.*

**Ex Situ**

The term *ex situ* or "moved from its original place," means excavated or removed.

**Filtration**

Filtration is a treatment process that removes solid matter from water by passing the water through a porous medium, such as sand or a manufactured filter.

**Flame Ionization Detector (FID)**

A FID is an instrument often used in conjunction with gas chromatography to measure the change of signal as analytes are ionized by a hydrogen-air flame. It also is used to detect phenols, phthalates, polynuclear aromatic hydrocarbons (PAH), VOCs, and petroleum hydrocarbons. *See also Portable Gas Chromatography.*

**Fourier Transform Infrared Spectroscopy**

A fourier transform infrared spectroscopy is an analytical air monitoring tool that uses a laser system chemically to identify contaminants.

**Fumigant**

A fumigant is a pesticide that is vaporized to kill pests. They often are used in buildings and greenhouses. *See also Dioxin.*

**Furan**

Furan is a colorless, volatile liquid compound used in the synthesis of organic compounds, especially nylon.

**Gas Chromatography**

Gas chromatography is a technology used for investigating and assessing soil, water, and soil gas contamination at a site. It is used for the analysis of VOCs and semivolatile organic compounds (SVOC). The technique identifies and quantifies organic compounds on the basis of molecular weight, characteristic fragmentation patterns, and retention time. Recent advances in gas chromatography that are considered innovative are portable, weather-proof units that have self-contained power supplies.

**Ground-Penetrating Radar**

GPR is a technology that emits pulses of electromagnetic energy into the ground to measure its reflection and refraction by subsurface layers and other features, such as buried debris.

**Groundwater**

Groundwater is the water found beneath the earth's surface that fills pores between such materials as sand, soil, or gravel and that often supplies wells and springs. *See also Aquifer.*

**Halogenated Organic Compound**

A halogenated organic compound is a compound containing molecules of chlorine, bromine iodine, and or fluorine. Halogenated organic compounds were used in high-voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. Many herbicides, pesticides, and degreasing agents are made from halogenated organic compounds.

**Hazard Ranking System (HRS)**

The HRS is the primary screening tool used by EPA to assess the risks posed to human health or the environment by abandoned or uncontrolled hazardous waste sites. Under the HRS, sites are assigned scores on the basis of the toxicity of hazardous substances that are present and the potential that those substances will spread through

the air, surface, water, or groundwater, taking into account such factors as the proximity of the substance to nearby populations. Scores are used in determining which sites should be placed on the NPL. *See also National Priorities List.*

### **Hazardous Substance**

As defined under CERCLA, a hazardous substance is any material that poses a threat to public health or the environment. The term also refers to hazardous wastes as defined under the Resource Conservation and Recovery Act (RCRA). Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive. If a certain quantity of a hazardous substance, as established by EPA, is spilled into the water or otherwise emitted into the environment, the release must be reported. Under the legislation cited above, the term excludes petroleum, crude oil, natural gas, natural gas liquids, or synthetic gas usable for fuel.

### **Hazardous and Solid Waste Amendments (HSWA)**

HSWA are 1984 amendments to RCRA which required phasing out land disposal of hazardous waste and added minimum technology requirements. *See also Resource Conservation and Recovery Act.*

### **Heavy Metal**

The term heavy metal refers to a group of toxic metals including arsenic, chromium, copper, lead, mercury, silver, and zinc. Heavy metals often are present at industrial sites at which operations have included battery recycling and metal plating.

### **Herbicide**

A herbicide is a chemical pesticide designed to control or destroy plants, weeds, or grasses.

### **High-Frequency Electromagnetic (EM) Sounding**

High-frequency EM sounding, the technology used for nonintrusive geophysical exploration, projects high-frequency electromagnetic radiation into subsurface layers to detect the reflection and refraction of the radiation by various layers of soil. Unlike ground-penetrating radar, which uses pulses, the technology uses continuous waves of radiation. *See also Ground-Penetrating Radar.*

### **Hydrazine**

Hydrazine is a highly toxic liquid used in rocket propellant, agricultural chemicals, drugs, spandex fibers, antioxidants, plating metals on glass and plastic, explosives, and in boiler feedwater. The chemical compound causes a severe explosion hazard when exposed to heat.

### **Hydrocarbon**

A hydrocarbon is an organic compound containing only hydrogen and carbon, often occurring in petroleum, natural gas, and coal.

### **Hydrogen Sulfide (HS)**

HS is a gas emitted during decomposition of organic compounds. It also is a byproduct of oil refining and burning.

### **Hydrogeology**

Hydrogeology is the study of groundwater, including its origin, occurrence, movement, and quality.

### **Hydrology**

Hydrology is the science that deals with the properties, movement, and effects of water found on the earth's surface, in the soil and rocks beneath the surface, and in the atmosphere.

### **Ignitability**

Ignitable wastes can create fires under certain conditions. Examples include liquids, such as solvents that readily catch fire, and friction-sensitive substances.

### **Immunoassay**

Immunoassay is an innovative technology used to measure compound-specific reactions (generally colorimetric) to individual compounds or classes of compounds. The reactions are used to detect and quantify contaminants. The technology is available in field-portable test kits.

### **Incineration**

Incineration is a treatment technology that involves the burning of certain types of solid, liquid, or gaseous materials under controlled conditions to destroy hazardous waste.

**Information Repository**

An information repository is a location in a public building that is convenient for local residents, such as a public school, city hall, or library, that contains information about a Superfund site, including technical reports and reference documents.

**Infrared Monitor**

An infrared monitor is a device used to monitor the heat signature of an object, as well as to sample air. It may be used to detect buried objects in soil.

**Inorganic Compound**

An inorganic compound is a compound that generally does not contain carbon atoms (although carbonate and bicarbonate compounds are notable exceptions), tends to be more soluble in water, and tends to react on an ionic rather than on a molecular basis. Examples of inorganic compounds include various acids, potassium hydroxide, and metals.

**Innovative Technology**

An innovative technology is a process that has been tested and used as a treatment for hazardous waste or other contaminated materials, but lacks a long history of full-scale use and information about its cost and how well it works sufficient to support prediction of its performance under a variety of operating conditions. An innovative technology is one that is undergoing pilot-scale treatability studies that usually are conducted in the field or the laboratory and require installation of the technology, and provide performance, cost, and design objectives for the technology. Innovative technologies are being used under many Federal and state cleanup programs to treat hazardous wastes that have been improperly released. For example, innovative technologies are being selected to manage contamination (primarily petroleum) at some leaking underground storage sites. *See also Emerging Technology and Established Technology.*

**Ion Exchange**

Ion exchange, a common method of softening water, depends on the ability of certain materials to remove and exchange ions from water. These ion exchange materials, generally composed of insoluble organic polymers, are placed in a filtering device. Water softening exchange materials remove calcium and magnesium ions, replacing them with sodium ions.

**Insecticide**

An insecticide is a pesticide compound specifically used to kill or control the growth of insects. *See also Dioxin.*

**In Situ**

The term in situ, "in its original place," or "on-site", means unexcavated and unmoved. In situ soil flushing and natural attenuation are examples of in situ treatment methods by which contaminated sites are treated without digging up or removing the contaminants.

**In Situ Oxidation**

In situ oxidation is an innovative treatment technology that oxidizes contaminants that are dissolved in groundwater and converts them into insoluble compounds.

**In Situ Soil Flushing**

In situ soil flushing is an innovative treatment technology that floods contaminated soils beneath the ground surface with a solution that moves the contaminants to an area from which they can be removed. The technology requires the drilling of injection and extraction wells on site and reduces the need for excavation, handling, or transportation of hazardous substances. Contaminants considered for treatment by in situ soil flushing include heavy metals (such as lead, copper, and zinc), halogenated organic compounds, aromatics, and PCBs. *See also Aromatics, Halogenated Organic Compound, Heavy Metal, and Polychlorinated Biphenyl.*

**In Situ Vittrification**

In situ vittrification is a soil treatment technology that stabilizes metal and other inorganic contaminants in place at temperatures of approximately 3000°F. Soils and sludges are fused to form a stable glass and crystalline structure with very low leaching characteristics.

**Institutional Controls**

An institutional control is a legal or institutional measure which subjects a property owner to limit activities at or access to a particular property. They are used to ensure protection of human health and the environment, and to expedite property reuse. Fences, posting or warning signs, and zoning and deed restrictions are examples of institutional controls.

**Integrated Risk Information System (IRIS)**

IRIS is an electronic database that contains EPA's latest descriptive and quantitative regulatory information about chemical constituents. Files on chemicals maintained in IRIS contain information related to both noncarcinogenic and carcinogenic health effects.

**Joint and Several Liability**

Under CERCLA, joint and several liability is a concept based on the theory that it may not be possible to apportion responsibility for the harm caused by hazardous waste equitably among potentially responsible parties (PRP) from that defendant. Joint liability means that more than one defendant is liable to the plaintiff. Several liability means that the plaintiff may choose to sue only one of the defendants and recover the entire amount. One PRP therefore can be held liable for the entire cost of cleanup, regardless of the share of waste that PRP contributed. Joint and several liability is used only when harm is indivisible. If defendants can apportion harm, there is no several liability. *See also Potentially Responsible Party and Strict Liability.*

**Land Disposal Restrictions (LDR)**

LDRs is a RCRA program that restricts the land disposal of RCRA hazardous wastes and requires treatment to promulgated treatment standards. The LDRs may be an important Applicable or Relevant and Appropriate Requirement (ARAR) for Superfund actions. *See also Applicable or Relevant and Appropriate Requirement and Resource Conservation and Recovery Act.*

**Landfarming**

Landfarming is the spreading and incorporation of wastes into the soil to initiate biological treatment.

**Landfill**

A sanitary landfill is a land disposal site for nonhazardous solid wastes at which the waste is spread in layers compacted to the smallest practical volume.

**Laser-Induced Fluorescence/Cone Penetrometer**

Laser-induced fluorescence/cone penetrometer is a field screening method that couples a fiber optic-based chemical sensor system to a cone penetrometer mounted on a truck. The technology can be used for investigating and assessing soil and water contamination.

**Leachate**

A leachate is a contaminated liquid that results when water collects contaminants as it trickles through wastes, agricultural pesticides, or fertilizers. Leaching may occur in farming areas and landfills and may be a means of the entry of hazardous substances into soil, surface water, or groundwater.

**Lead**

Lead is a heavy metal that is hazardous to health if breathed or swallowed. Its use in gasoline, paints, and plumbing compounds has been sharply restricted or eliminated by Federal laws and regulations. *See also Heavy Metal.*

**Leaking Underground Storage Tank (LUST)**

LUST is the acronym for "leaking underground storage tank." *See also Underground Storage Tank.*

**Light Nonaqueous Phase Liquid (LNAPL)**

An LNAPL is one of a group of organic substances that are relatively insoluble in water and are less dense than water. LNAPLs, such as oil, tend to spread across the surface of the water table and form a layer on top of the water table.

**Magnetometry**

Magnetometry is a geophysical technology used to detect disruptions that metal objects cause in the earth's localized magnetic field.

**Mass Spectrometry**

Mass spectrometry is an analytical process by which molecules are broken into fragments to determine the concentrations and mass/charge ratio of the fragments. Innovative mass spectroscopy units, developed through modification of large laboratory instruments, are sometimes portable, weatherproof units with self-contained power supplies.

**Medium**

A medium is a specific environment--air, water, or soil--which is the subject of regulatory concern and activities.

**Mercury**

Mercury is a heavy metal that can accumulate in the environment and is highly toxic if breathed or swallowed. Mercury is a highly toxic substance found in thermometers, measuring devices, pharmaceutical and agricultural chemicals, chemical manufacturing, and electrical equipment. *See also Heavy Metal.*

**Mercury Vapor Analyzer**

A mercury vapor analyzer is an instrument that provides real-time measurements of concentrations of mercury in the air.

**Methane**

Methane is a colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds.

**Migration Pathway**

A migration pathway is a potential path or route of contaminants from the source of contamination to contact with human populations or the environment. Migration pathways include air, surface water, groundwater, and land surface. The existence and identification of all potential migration pathways must be considered during assessment and characterization of a waste site.

**Mixed Waste**

Mixed waste is low-level radioactive waste contaminated with hazardous waste that is regulated under RCRA. Mixed waste can be disposed only in compliance with the requirements under RCRA that govern disposal of hazardous waste and with the RCRA land disposal restrictions, which require that waste be treated before it is disposed of in appropriate landfills.

**Monitoring Well**

A monitoring well is a well drilled at a specific location on or off a hazardous waste site at which groundwater can be sampled at selected depths and studied to determine the direction of groundwater flow and the types and quantities of contaminants present in the groundwater.

**National Contingency Plan (NCP)**

The NCP, formally the National Oil and Hazardous Substances Contingency Plan, is the major regulatory framework that guides the Superfund response effort. The NCP is a comprehensive body of regulations that outlines a step-by-step process for implementing Superfund responses and defines the roles and responsibilities of EPA, other Federal agencies, states, private parties, and the communities in response to situations in which hazardous substances are released into the environment. *See also Superfund.*

**National Pollutant Discharge Elimination System (NPDES)**

NPDES is the primary permitting program under the Clean Water Act, which regulates all discharges to surface water. It prohibits discharge of pollutants into waters of the United States unless EPA, a state, or a tribal government issues a special permit to do so.

**National Priorities List (NPL)**

The NPL is EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under Superfund. Inclusion of a site on the list is based primarily on the score the site receives under the HRS. Money from Superfund can be used for cleanup only at sites that are on the NPL. EPA is required to update the NPL at least once a year. *See also Hazard Ranking System and Superfund.*

**National Response Center (NRC)**

The NRC, staffed by the U.S. Coast Guard, is a communications center that receives reports of discharges or releases of hazardous substances into the environment. The U.S. Coast Guard in turn, relays information about such releases to the appropriate Federal agency.

**Natural Attenuation**

Natural attenuation is an approach to cleanup that uses natural processes to contain the spread of contamination from chemical spills and reduce the concentrations and amounts of pollutants in contaminated soil and groundwater. Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, are allowed to reduce concentrations of contaminants to acceptable levels. An in situ treatment method that leaves the contaminants in place while those processes occur, natural attenuation is being used to clean up petroleum contamination from leaking underground storage tanks (LUST) across the country.

**Nitric Oxide**

Nitric oxide is a gas formed by combustion under high temperature and high pressure in an internal combustion engine.

**Nonaqueous Phase Liquid (NAPL)**

NAPLs are organic substances that are relatively insoluble in water and are less dense than water. *See also Dense Nonaqueous Phase Liquid and Light Nonaqueous Phase Liquid.*

**Non-Point Source**

The term non-point source is used to identify sources of pollution that are diffuse and do not have a point of origin or that are not introduced into a receiving stream from a specific outlet. Common non-point sources are rain water, runoff from agricultural lands, industrial sites, parking lots, and timber operations, as well as escaping gases from pipes and fittings.

**Operation and Maintenance (O&M)**

O&M refers to the activities conducted at a site, following remedial actions, to ensure that the cleanup methods are working properly. O&M activities are conducted to maintain the effectiveness of the remedy and to ensure that no new threat to human health or the environment arises. The state or PRP assumes responsibility for O&M, which may include such activities as groundwater and air monitoring, inspection and maintenance of the treatment equipment remaining on site, and maintenance of any security measures or institutional controls.

**Organic Chemical or Compound**

An organic chemical or compound is a substance produced by animals or plants that contains mainly carbon, hydrogen, and oxygen.

**Ozone**

Ozone is a form of oxygen found naturally which provides a protective layer shielding the earth from the harmful health effects on human health and the environment from ultraviolet radiation. Ozone is a chemical oxidant and a major component of smog in the troposphere, the earth's atmospheric layer extending 7 to 10 miles from the earth's surface. Ozone can have a serious effect on the human respiratory system and is one of the most prevalent and widespread of all the criteria pollutants for which the Clean Air Act required EPA to set standards.

**Pentachlorophenol (PCP)**

PCP, a chemical compound containing carbon, chlorine, oxygen, and hydrogen, is a contaminant used in feed stock material and chemical manufacturing.

**Permeability**

Permeability is a characteristic that represents a qualitative description of the relative ease with which rock, soil, or sediment will transmit a fluid (liquid or gas).

**Pesticide**

A pesticide is a substance or mixture of substances intended to prevent or mitigate infestation by, or destroy or repel, any pest. Pesticides can accumulate in the food chain and or contaminate the environment if misused. *See also Dioxin.*

**Phase I Environmental Audit**

A Phase I environmental audit is an initial environmental investigation that is limited to a historical records search to determine ownership of a site and to identify the kinds of chemical processes that were carried out at the site. A Phase I audit includes a site visit, but does not include any sampling. If such an audit identifies no significant concerns, Phase II and III audits are not necessary.

**Phase II Environmental Audit**

A Phase II environmental audit is an investigation that includes tests performed at the site to confirm the location and identity of environmental hazards. The audit includes preparation of a report that includes recommendations for cleanup alternatives.

**Phase III Environmental Audit**

A Phase III environmental audit is the third-step in the audit that includes the removal of contaminated materials from a site and their legal disposal.

**Phenols**

A phenol is one of a group of organic compounds that are byproducts of petroleum refining, tanning, and textile, dye, and resin manufacturing. Low concentrations of phenols cause taste and odor problems in water; higher concentrations may be harmful to human health or the environment.

**Photoionization Detector (PID)**

A PID is a nondestructive detector, often used in conjunction with gas chromatography, that measures the change of signal as analytes are ionized by an ultraviolet lamp. The PID also is used to detect VOCs and petroleum hydrocarbons. *See also Portable Gas Chromatography.*

**Phytoremediation**

Phytoremediation is an innovative treatment technology that uses plants and trees to clean up contaminated soil and water. Plants can break down, or degrade, organic pollutants or stabilize metal contaminants by acting as filters or traps. Phytoremediation can be used to clean up metals, pesticides, solvents, explosives, crude oil, polyaromatic carbons, and landfill leachates. Its use generally is limited to sites at which concentrations of contaminants are relatively low and contamination is found in shallow soils, streams, and groundwater.

**Plasma High-Temperature Metals Recovery**

Plasma high-temperature metals recovery is a thermal treatment process that purges contaminants from solids and soils such as metal fumes and organic vapors. The vapors can be burned as fuel, and the metal fumes can be recovered and recycled. This innovative treatment technology is used to treat contaminated soil and groundwater.

**Plume**

A plume is a visible or measurable emission or discharge of a contaminant from a given point of origin into any medium. The term also is used to refer to measurable and potentially harmful radiation leaking from a damaged reactor.

**Point Source**

A point source is a stationary location or fixed facility from which pollutants are discharged or emitted or any single, identifiable discharge point of pollution, such as a pipe, ditch, or smokestack.

**Polychlorinated Biphenyl (PCB)**

PCBs are a group of toxic, persistent chemicals, produced by chlorination of biphenyl, that once were used in high voltage electrical transformers because they conducted heat well while being fire resistant and good electrical insulators. These contaminants

typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Further sale or use of PCBs was banned in 1979.

**Polynuclear Aromatic Hydrocarbon (PAH)**

A PAH is a chemical compound that contains more than one fused benzene ring. They are commonly found in petroleum fuels, coal products, and tar.

**Potentially Responsible Party (PRP)**

A PRP is an individual or company (such as owners, operators, transporters, or generators of hazardous waste) that is potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated. *See also Superfund.*

**Preliminary Assessment and Site Investigation (PA/SI)**

A preliminary assessment (PA) is the process of collecting and reviewing available information about a known or suspected hazardous waste site or release. The PA usually includes a visit to the site.

**Presumptive Remedies**

Presumptive remedies are preferred technologies for common categories of CERCLA sites that have been identified through historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation.

**Pump and Treat**

Pump and treat is a general term used to describe remediation methods that involve the pumping of groundwater to the surface for treatment. It is one of the most common methods of treating polluted aquifers and groundwater.

**Quality Assurance and Quality Control (QA/QC)**

QA/QC is a system of procedures, checks, audits, and corrective actions applied to ensure that all EPA research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

**Radioactive Waste**

Radioactive waste is any waste that emits energy as rays, waves, or streams of energetic particles. Sources of such wastes include nuclear reactors, research institutions, and hospitals.

**Radionuclide**

A radionuclide is a radioactive element characterized according to its atomic mass and atomic number, which can be artificial or naturally occurring. Radionuclides have a long life as soil or water pollutants. Radionuclides cannot be destroyed or degraded; therefore, applicable technologies involve separation, concentration and volume reduction, immobilization, or vitrification. *See also Solidification and Stabilization.*

**Radon**

Radon is a colorless, naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium atoms. *See also Radioactive Waste and Radionuclide.*

**RCRA Facility Assessment (RFA)**

A RFA is performed at a facility to determine the existence of any continuous or non-continuous releases of wastes. During the RFA, EPA or state regulators gather information on solid waste management units and other areas of concern at RCRA facilities, evaluate this information to determine whether there are releases that warrant further investigation and action, and determine the need to proceed to a RCRA Facility Investigation. *See also Resource Conservation and Recovery Act.*

**RCRA Facility Investigation (RFI)**

The purpose of a RFI is to gather sufficient data at a facility to fully characterize the nature, extent, and rate of migration of contaminant releases identified in the RCRA Facility Assessment. The data generated during the RFI is used to determine the potential need for corrective measures and to aid in the selection and implementation of these measures. *See also Corrective Measure Study and Resource Conservation and Recovery Act.*

**Reactivity**

Reactive wastes are unstable under normal conditions. They can create explosions and or toxic fumes, gases, and vapors when mixed with water.

**Record of Decision (ROD)**

A record of decision (ROD) is a legal, technical, and public document that explains which cleanup alternative will be used at a site. The ROD is based on information and technical analysis generated during the remedial investigation and feasibility study (RI/FS) and consideration of public comments and community concerns. *See also Preliminary Assessment and Site Investigation and Remedial Investigation and Feasibility Study.*

**Release**

A release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, leaching, dumping, or disposing into the environment of a hazardous or toxic chemical or extremely hazardous substance, as defined under RCRA. *See also Resource Conservation and Recovery Act.*

**Remedial Design and Remedial Action (RD/RA)**

The RD/RA is the step in the cleanup process that follows the remedial investigation and feasibility study (RI/FS) and selection of a remedy. A remedial design (RD) is the preparation of engineering plans and specifications to properly and effectively implement the remedy. The remedial action (RA) is the actual construction or implementation of the remedy. *See also Remedial Investigation and Feasibility Study.*

**Remedial Investigation and Feasibility Study (RI/FS)**

The RI/FS is the step in the cleanup process that is conducted to gather sufficient information to support the selection of a site remedy that will reduce or eliminate the risks associated with contamination at the site. The remedial investigation (RI) involves site characterization -- collection of data and information necessary to characterize the nature and extent of contamination at the site. The RI also determines whether the contamination presents a significant risk to human health or the environment. The feasibility study (FS) focuses on the development of specific response alternatives for addressing contamination at a site.

**Removal Action**

A removal action usually is a short-term effort designed to stabilize or clean up a hazardous waste site that poses an immediate threat to human health or the environment. Removal actions include removing tanks or drums of hazardous substances



that were found on the surface and installing drainage controls or security measures, such as a fence at the site. Removal actions also may be conducted to respond to accidental releases of hazardous substances. CERCLA places time and money constraints on the duration of removal actions. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

**Reportable Quantity (RQ)**

The RQ is the quantity of hazardous substances that, when released into the environment, can cause substantial endangerment to public health or the environment. Under CERCLA, the Federal government must be notified when quantities equaling or exceeding RQs specified in regulations are released.

**Resin**

Resins are solids or semi-solids of plant origin used principally in lacquers, varnishes, inks, adhesives, synthetic plastics, and pharmaceuticals.

**Resource Conservation and Recovery Act (RCRA)**

RCRA is a Federal law enacted in 1976 that established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

**Response Action**

A response action is a short-term removal action or a long-term remedial response, authorized under CERCLA that is taken at a site to address releases of hazardous substances.

**Risk Communication**

Risk communication, the exchange of information about health or environmental risks among risk assessors, risk managers, the local community, news media and interest groups, is the process of informing members of the local community about environmental risks associated with a site and the steps that are being taken to manage those risks.

**Sanborn Map**

A Sanborn map is a record kept for insurance purposes that shows, for a specific property, the locations of such items as underground storage tanks (UST), buildings, and areas where chemicals have been used for certain industrial processes. A Phase I environmental audit includes a review of Sanborn maps. *See also Phase I Environmental Audit.*

**Saturated Zone**

The saturated zone is the area beneath the surface of the land in which all openings are filled with water at greater than atmospheric pressure.

**Seismic Reflection and Refraction**

Seismic reflection and refraction is a technology used to examine the geophysical features of soil and bedrock, such as debris, buried channels, and other features.

**Semi-Volatile Organic Compound (SVOC)**

SVOCs, composed primarily of carbon and hydrogen atoms, have boiling points greater than 200°C. Common SVOCs include PCPs and phenol. *See also Phenol and Polychlorinated Biphenyl.*

**Sludge**

Sludge is a semisolid residue from air or water treatment processes. Residues from treatment of metal wastes and the mixture of waste and soil at the bottom of a waste lagoon are examples of sludge, which can be a hazardous waste.

**Slurry-Phase Bioremediation**

Slurry-phase bioremediation, a treatment technology that can be used alone or in conjunction with other biological, chemical, and physical treatments, is a process through which organic contaminants are converted to innocuous compounds. Slurry-phase bioremediation can be effective in treating various SVOCs and nonvolatile organic compounds, as well as fuels, creosote, pentachlorophenols (PCP), and PCBs.

**Soil Boring**

Soil boring is a process by which a soil sample is extracted from the ground for chemical, biological, and analytical testing to determine the level of contamination present.

**Soil Gas**

Soil gas consists of gaseous elements and compounds that occur in the small spaces between particles of the earth and soil. Such gases can move through or leave the soil or rock, depending on changes in pressure.

**Soil Vapor Extraction (SVE)**

SVE, the most frequently selected innovative treatment at Superfund sites, is a process that physically separates contaminants from soil in a vapor form by exerting a vacuum through the soil formation. Soil vapor extraction removes VOCs and some SVOCs from soil beneath the ground surface.

**Soil Washing**

Soil washing is an innovative treatment technology that uses liquids (usually water, sometimes combined with chemical additives) and a mechanical process to scrub soils, removes hazardous contaminants, and concentrates the contaminants into a smaller volume. The technology is used to treat a wide range of contaminants, such as metals, gasoline, fuel oils, and pesticides. Soil washing is a relatively low-cost alternative for separating waste and minimizing volume as necessary to facilitate subsequent treatment. It is often used in combination with other treatment technologies. The technology can be brought to the site, thereby eliminating the need to transport hazardous wastes.

**Solidification and Stabilization**

Solidification and stabilization are the processes of removing wastewater from a waste or changing it chemically to make the waste less permeable and susceptible to transport by water. Solidification and stabilization technologies can immobilize many heavy metals, certain radionuclides, and selected organic compounds, while decreasing the surface area and permeability of many types of sludge, contaminated soils, and solid wastes.

**Solvent**

A solvent is a substance, usually liquid, that is capable of dissolving or dispersing one or more other substances.

**Solvent Extraction**

Solvent extraction is an innovative treatment technology that uses a solvent to separate or remove hazardous organic contaminants from oily-type wastes, soils, sludges, and sediments. The technology does not destroy contaminants, but concentrates them so they can be recycled or destroyed more easily by another technology. Solvent extraction has been shown to be effective in treating sediments, sludges, and soils that contain primarily organic contaminants, such as PCBs, VOCs, halogenated organic compounds, and petroleum wastes. Such contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes. Solvent extraction is a transportable technology that can be brought to the site. *See also Halogenated Organic Compound, Polychlorinated Biphenyl, and Volatile Organic Compound.*

**Strict Liability**

Strict liability is a concept under CERCLA that empowers the Federal government to hold PRPs liable without proving that the PRPs were at fault and without regard to a PRP's motive. PRPs can be found liable even if the problems caused by the release of a hazardous substance were unforeseeable, the PRPs acted in good faith, and state-of-the-art hazardous waste management practices were used at the time the materials were disposed of. *See also Potentially Responsible Party.*

**Surfactant Flushing**

Surfactant flushing is an innovative treatment technology used to treat contaminated groundwater. Surfactant flushing of NAPLs increases the solubility and mobility of the contaminants in water so that the NAPLs can be biodegraded more easily in an aquifer or recovered for treatment aboveground. *See also Nonaqueous Phase Liquid.*

**Surface Water**

Surface water is all water naturally open to the atmosphere, such as rivers, lakes, reservoirs, streams, and seas.

**Superfund**

Superfund is the trust fund that provides for the cleanup of hazardous substances released into the environment, regardless of fault. The Superfund was established under CERCLA and subsequent amendments to CERCLA. The term Superfund also is used to refer to cleanup programs designed and conducted under CERCLA and its subsequent amendments. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

**Superfund Amendment and Reauthorization Act (SARA)**

SARA is the 1986 act amending CERCLA that increased the size of the Superfund trust fund and established a preference for the development and use of permanent remedies, and provided new enforcement and settlement tools. *See also Comprehensive Environmental Response, Compensation, and Liability Act.*

**Superfund Innovative Technology Evaluation (SITE) Program**

The SITE program is an effort established by EPA in 1986 to advance the development, evaluation, and commercialization of innovative treatment technologies for assessing and cleaning up hazardous waste sites. The program provides an opportunity for technology developers to demonstrate their technologies' ability to successfully process and remediate hazardous waste. The SITE program has four components—the Emerging Technology Program, the Demonstration Program, the Monitoring and Measurement Technologies Program, and the Technology Transfer Program.

**Thermal Desorption**

Thermal desorption is an innovative treatment technology that heats soils contaminated with hazardous wastes to temperatures from 200 to 1,000°F so that contaminants that have low boiling points will vaporize and separate from the soil. The vaporized contaminants then are collected for further treatment or destruction, typically by an air emissions treatment system. The technology is most effective at treating VOCs, SVOCs and other organic contaminants, such as PCBs, PAHs, and pesticides. It is effective in separating organics from refining wastes, coal tar wastes, waste from wood treatment, and paint wastes. It also can separate solvents, pesticides, PCBs, dioxins, and fuel oils from

contaminated soil. *See also Polyaromatic Hydrocarbon, Polychlorinated Biphenyl, Semivolatile Organic Compound, and Volatile Organic Compound.*

**Total Petroleum Hydrocarbon (TPH)**

TPH refers to a measure of concentration or mass of petroleum hydrocarbon constituents present in a given amount of air, soil, or water.

**Toxicity**

Toxicity is a quantification of the degree of danger posed by a substance to animal or plant life.

**Toxicity Characteristic Leaching Procedure (TCLP)**

The TCLP is a testing procedure used to identify the toxicity of wastes and is the most commonly used test for degree of mobilization offered by a solidification and stabilization process. Under this procedure, a waste is subjected to a process designed to model the leaching effects that would occur if the waste was disposed of in a RCRA Subtitle D municipal landfill. *See also Solidification and Stabilization.*

**Toxic Substance**

A toxic substance is a chemical or mixture that may present an unreasonable risk of injury to health or the environment.

**Toxic Substances Control Act (TSCA)**

TSCA was enacted in 1976 to test, regulate, and screen all chemicals produced or imported into the U.S. TSCA requires that any chemical that reaches the consumer marketplace be tested for possible toxic effects prior to commercial manufacture. Any existing chemical that poses health and environmental hazards is tracked and reported under TSCA.

**Treatment, Storage, and Disposal Facility (TSD)**

TSDs are sites at which hazardous substances are treated, stored, or disposed. TSD facilities are regulated by EPA and states under RCRA. *See also Resource Conservation and Recovery Act.*

**Treatment Wall (also Passive Treatment Wall)**

A treatment wall is a structure installed underground to treat contaminated groundwater found at hazardous waste sites. Treatment walls, also called passive treatment walls, are put in place by constructing a giant trench across the flow path of

contaminated groundwater and filling the trench with one of a variety of materials carefully selected for the ability to clean up specific types of contaminants. As the contaminated groundwater passes through the treatment wall, the contaminants are trapped by the treatment wall or transformed into harmless substances that flow out of the wall. The major advantage of using treatment walls is that they are passive systems that treat the contaminants in place so the property can be put to productive use while it is being cleaned up. Treatment walls are useful at some sites contaminated with chlorinated solvents, metals, or radioactive contaminants.

**Trichloroethylene (TCE)**

TCE is a stable, low-boiling colorless liquid that is used as a solvent, metal degreasing agent, and in other industrial applications.

**Underground Storage Tank (UST)**

A UST is a tank located entirely or partially underground that is designed to hold gasoline or other petroleum products or chemical solutions.

**Unsaturated Zone**

The unsaturated zone is the area between the land surface and the uppermost aquifer (or saturated zone). The soils in an unsaturated zone may contain air and water.

**Vadose Zone**

The vadose zone is the area between the surface of the land and the aquifer water table in which the moisture content is less than the saturation point and the pressure is less than atmospheric. The openings (pore spaces) also typically contain air or other gases.

**Vapor**

Vapor is the gaseous phase of any substance that is liquid or solid at atmospheric temperatures and pressures. Steam is an example of a vapor.

**Volatile Organic Compound (VOC)**

A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. Examples of volatile organic compounds include trichloroethane, trichloroethylene, benzene, toluene, ethylbenzene, and xylene (BTEX). These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

**Volatilization**

Volatilization is the process of transfer of a chemical from the aqueous or liquid phase to the gas phase. Solubility, molecular weight, and vapor pressure of the liquid and the nature of the gas-liquid affect the rate of volatilization.

**Voltammetric Stripping**

Voltammetric stripping is a field-portable technology that uses electrochemistry to detect and quantify metals in environmental samples. Specific metals can be targeted for detection and quantification by the technology, which generally is applied to water samples.

**Voluntary Cleanup Program (VCP)**

A VCP is a formal means established by many states to facilitate assessment, cleanup, and redevelopment of Brownfields sites. VCPs typically address the identification and cleanup of potentially contaminated sites that are not on the NPL. Under VCPs, owners or developers of a site are encouraged to approach the state voluntarily to work out a process by which the site can be readied for development. Many state VCPs provide technical assistance, liability assurances, and funding support for such efforts. *See also National Priorities List.*

**Wastewater**

Wastewater is spent or used water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

**Water Table**

A water table is the boundary between the saturated and unsaturated zones beneath the surface of the earth, the level of groundwater, and generally is the level to which water will rise in a well. *See also Aquifer and Groundwater.*

**X-Ray Fluorescence Analyzer**

An x-ray fluorescence analyzer is a self-contained, field-portable instrument, consisting of an energy dispersive x-ray source, a detector, and a data processing system that detects and quantifies individual metals or groups of metals.

This page intentionally left blank.

# **APPENDIX D**



Appendix D

**LIST OF BROWNFIELDS  
AND TECHNICAL SUPPORT CONTACTS**

---

The lists included in this appendix identify contacts at the state and EPA regional levels, as well as EPA technical support staff in the Technology Innovation Office and the Office of Research and Development. The individuals are available to assist cleanup and redevelopment efforts at Brownfields sites.

State Brownfields Contacts ..... D-2

EPA Regional Brownfields Coordinators ..... D-6

EPA Technical Support ..... D-7



**STATE BROWNFIELDS  
CONTACTS****ALABAMA**

---

Daniel Cooper  
Site Mitigation Branch  
AL Department of Environmental  
Management  
P.O. Box 301463  
Montgomery, AL 36130-1463  
Phone: (334)271-7711  
Fax: (334)271-7950

**ALASKA**

---

Anne Marie Gillespie  
AK Department of Environmental  
Conservation  
410 Willoughby Avenue  
Juneau, AK 99801  
Phone: (907)465-5287  
Fax: (907)465-5262

**ARIZONA**

---

Tim Steele  
AZ Department of Environmental  
Quality  
3033 North Central Avenue  
Phoenix, AZ 85012  
Phone: (602)207-4224  
Fax: (602)207-4236

**ARKANSAS**

---

Jean Koeninger  
Hazardous Waste Division  
AR Department of Pollution Control  
and Ecology  
8001 National Drive  
P.O. Box 8913  
Little Rock, AR 72219-8913  
Phone: (501)682-0854  
Fax: (501)682-0565

**CALIFORNIA**

---

Barbara Coler  
Site Mitigation Program  
Department of Toxic Substances  
Control  
CA Environmental Protection Agency  
700 Heinz Avenue, #200  
Berkeley, CA 94710-2737  
Phone: (510)540-3827  
Fax: (510)540-3819

**COLORADO**

---

Daniel Scepters  
Hazardous Waste Materials and  
Waste Management Division  
CO Department of Public Health and  
Environment  
4300 Cherry Creek Drive South  
Denver, CO 80222-1530  
Phone: (303)692-3398  
Fax: (303)759-5355

**CONNECTICUT**

---

Elsie Patton  
Remediation Division  
Bureau of Waste Management  
CT Department of Environmental  
Protection  
79 Elm Street  
Hartford, CT 06106  
Phone: (203)424-3762  
Fax: (203)424-4057

**DELAWARE**

---

Karl Kalbacher  
Air and Waste Management Division  
DE Department of Natural Resources  
and Environmental Control  
715 Grantham Lane  
New Castle, DE 19720-4801  
Phone: (302)323-4540  
Fax: (302)323-4561

**FLORIDA**

---

Joseph McGarrity  
Division of Waste Management  
Bureau of Waste Cleanup  
FL Department of Environmental  
Protection  
2600 Blair Stone Road  
Mailstation #4500  
Tallahassee, FL 32399-2400  
Phone: (904)488-3935  
Fax: (904)922-4368

**GEORGIA**

---

Jennifer Kaduck  
Hazardous Waste Management  
Branch  
Environmental Protection Division  
GA Department of Natural Resources  
205 Butler Street, SE  
Suite 1154, East Tower  
Atlanta, GA 30334  
Phone: (404)656-7802  
Fax: (404)651-9425

**HAWAII**

---

Steven Armann  
Hazardous Evaluation and  
Emergency Response Office  
Environmental Management Division  
HI Department of Health  
919 Ala Moana Boulevard, Suite 206  
Honolulu, HI 96814  
Phone: (808)586-4250  
Fax: (808)586-7537

**IDAHO**

---

Dean Nygard  
Community Services Branch  
Division of Environmental Quality  
ID Department of Health and Welfare  
1410 N. Hilton Street  
Boise, ID 83706  
Phone: (208)373-0502  
Fax: (208)373-0576

**ILLINOIS**

---

Larry Eastap  
Bureau of Land  
IL Environmental Protection Agency  
2200 Churchill Rd.  
P.O. Box 19276  
Springfield, IL 62794-9276  
Phone: (217)782-9802  
Fax: (217)782-3258

**STATE BROWN FIELDS CONTACTS**

(continued)

**INDIANA**

Carla Gill  
Project Management Branch  
Office of Environmental Response  
IN Department of Environmental  
Management  
P.O. Box 6015  
100 North Senate Avenue  
Indianapolis, IN 46206-6015  
Phone: (317)308-3123  
Fax: (317)308-3123

**IOWA**

Allan Stokes  
Environmental Protection Division  
IA Department of Natural Resources  
900 E. Grand Avenue  
Henry A. Wallace Building  
Des Moines, IA 50319-0034  
Phone: (515)281-6284  
Fax: (515)281-8895

**KANSAS**

Larry Knoche  
Division of Environment  
Bureau of Environmental  
Remediation  
KS Department of Health and  
Environment  
Forbes Field, Building 283  
Topeka, KS 66620  
Phone: (913)296-1662  
Fax: (913)296-1686

**KENTUCKY**

Jeffrey Pratt  
Division of Waste Management  
KY Department of Environmental  
Protection  
Frankfort Office Park  
14 Reilly Road  
Frankfort, KY 40601  
Phone: (502)564-6716  
Fax: (502)564-2705

**LOUISIANA**

John Halk  
Department of Environmental Quality  
Office of Solid and Hazardous Waste  
P.O. Box 82178  
Baton Rouge, LA 70884-2178  
Phone: (304)765-0487  
Fax: (304)765-0484

**MAINE**

Nicholas Hodgkins  
ME Department of Environmental  
Protection  
State House Station 17  
Augusta, ME 04333  
Phone: (207)287-2651  
Fax: (207)287-7826

**MARYLAND**

Bob DeMarco  
Environmental Response and  
Restoration Program  
Waste Management Administration  
MD Department of the Environment  
2500 Broening Highway  
Baltimore, MD 21224  
Phone: (410)631-3437  
Fax: (410)631-3472

**MASSACHUSETTS**

Sarah Weinstein  
Policy and Program Development  
Division  
Bureau of Waste Site Cleanup  
MA Department of Environmental  
Protection  
1 Winter Street  
Boston, MA 02108  
Phone: (617)292-5820  
Fax: (617)556-1049

**MICHIGAN**

Claudia Kerbawy  
Act 307 Section  
Environmental Response Division  
MI Department of Environmental  
Quality  
P.O. Box 30028  
Lansing, MI 48909  
Phone: (517)335-3397  
Fax: (517)373-9657

**MINNESOTA**

Deb DeLuca  
Ground Water and Solid Waste  
Division  
MN Office of Environmental  
Assistance  
520 Lafayette Rd. North, 2nd Fl.  
Saint Paul, MN 55155-4100  
Phone: (612)296-0892  
Fax: (612)296-9707

**MISSISSIPPI**

Jerry Banks  
Hazardous Waste Division  
Office of Pollution Control  
MS Department of Environmental  
Quality  
2380 Highway 80 West  
P.O. Box 10385  
Jackson, MS 39289  
Phone: (601)961-5171 x5221  
Fax: (601)961-5741

**MISSOURI**

Jim Belcher  
Voluntary Cleanup Section  
Division of Environmental Quality  
Hazardous Waste Management  
Program  
MO Department of Natural Resources  
205 Jefferson Street  
P.O. Box 176  
Jefferson City, MO 65102  
Phone: (573)751-3176  
Fax: (573)526-8922

**MONTANA**

Carol Fox  
State CERCLA Program  
Environmental Remediation Division  
MT Department of Environmental  
Quality  
P.O. Box 200901  
Helena, MT 59620-0901  
Phone: (406)444-1420  
Fax: (406)444-1901

**NEBRASKA**

Jeff Kelley  
Air and Waste Management Division  
NE Department of Environmental  
Quality  
1200 North Street, Suite 400  
Lincoln, NE 68508  
Phone: (402)471-3388  
Fax: (402)471-2909

**NEVADA**

Robert Kelso  
Remediation Branch  
NV Department of Environmental  
Protection  
333 West Nye Lane  
Carson City, NV 89706-866  
Phone: (702)687-4670 x3020  
Fax: (702)687-6396

**STATE BROWNFIELDS CONTACTS**

(continued)

**NEW HAMPSHIRE**

Gary Lynn  
Hazardous Waste Sites  
Waste Management Division  
NH Department of Environmental  
Services  
6 Hazen Drive  
Concord, NH 03301-6509  
Phone: (603) 271-6778  
Fax: (603) 271-6778

Mike Wimsatt  
Hazardous Waste Sites  
Waste Management Division  
NH Department of Environmental  
Services  
6 Hazen Drive  
Concord, NH 03301-6509  
Phone: (603) 271-2456  
Fax: (603) 271-6778

**NEW JERSEY**

Ron Corcorry  
Site Remediation Program  
Division of Responsible Party Site  
Remediation  
NJ Department of Environmental  
Protection  
401 E. State Street, CN028  
Trenton, NJ 08625  
Phone: (609) 633-1480  
Fax: (609) 633-1454

**NEW MEXICO**

Susan Morris  
Superfund Oversight Section/  
GWOB/NMED  
P.O. Box 26110  
Santa Fe, NE 87502  
Phone: (505) 827-2890  
Fax: (505) 827-2965

**NEW YORK**

Christine Costopoulos  
Division of Environmental  
Remediation  
NY Department of Environmental  
Conservation  
50 Wolf Road, Room 260B  
Albany, NY 12233-7010  
Phone: (518) 457-5861  
Fax: (518) 485-8404

**NORTH CAROLINA**

Grover Nicholson  
Superfund Section  
Division of Solid Waste Management  
NC Department of Environmental,  
Health and Natural Resources  
P.O. Box 29603  
Raleigh, NC 27611-9603  
Phone: (919) 733-2801x291  
Fax: (919) 733-4811

**NORTH DAKOTA**

Neil Knatterud  
Division of Waste Management  
ND Department of Health  
1200 Missouri Avenue, #302  
P.O. Box 5520  
Bismark, ND 58502-5520  
Phone: (701) 328-5166  
Fax: (701) 328-5200

**OHIO**

Jenifer Kwasniewski  
Voluntary Action Program  
Division of Emergency and Remedial  
Response  
OH Environmental Protection Agency  
1800 Watermark Drive  
Columbus, OH 43215-1099  
Phone: (614) 644-2924  
Fax: (614) 728-1791

**OKLAHOMA**

Catherine Sharp  
Waste Management Division  
OK Department of Environmental  
Quality  
1000 NE 10<sup>th</sup> Street  
Oklahoma City, OK 73117-1212  
Phone: (405) 271-5338  
Fax: (405) 328-5200

**OREGON**

Mike Rosen  
Voluntary Cleanup Section  
Waste Management and Cleanup  
Division  
OR Department of Environmental  
Quality  
2020 SW 4<sup>th</sup> Avenue, #400  
Portland, OR 97204-1390  
Phone: (503) 229-6712  
Fax: (503) 229-6899

**PENNSYLVANIA**

Tom Fidler  
Land Recycling and Cleanup Program  
Rachel Carson State Office Building  
P.O. Box 8471  
Harrisburg, PA 17105-8471  
Phone: (717) 783-7816  
Fax: (717) 787-0884

**RHODE ISLAND**

Terrence Gray  
Division of Site Remediation  
RI Department of Environmental  
Management  
291 Promenade Street  
Providence, RI 02905  
Phone: (401) 277-3872x7100  
Fax: (401) 277-2017

**SOUTH CAROLINA**

Gail Rawls Jeter  
Bureau of Solid and Hazardous Waste  
Management  
SC Department of Health and  
Environmental Control  
2600 Bull Street  
Columbia, SC 29201  
Phone: (803) 896-4069  
Fax: (803) 896-4292

Julie E. Fridell  
Bureau of Solid and Hazardous Waste  
Management  
SC Department of Health and  
Environmental Control  
2600 Bull Street  
Columbia, SC 29201  
Phone: (803) 896-4082  
Fax: (803) 896-4292

**SOUTH DAKOTA**

Lee Baron  
Division of Environmental Services  
SD Department of Environment and  
Natural Resources  
523 East Capitol, Foss Building  
Pierre, SD 57501-3181  
Phone: (605) 773-3296  
Fax: (605) 773-6035

**STATE BROWN FIELDS CONTACTS****(continued)****TENNESSEE**

---

Andrew Shivas  
Voluntary Cleanup Program  
Division of Superfund  
TN Department of Environment and  
Conservation  
401 Church Street  
LandC Annex, 15th Fl.  
Nashville, TN 37243-1538  
Phone: (615) 532-0912  
Fax: (615) 532-0938

**TEXAS**

---

Chuck Epperson  
Voluntary Cleanup Program  
Pollution Cleanup Division  
TX Natural Resource Conservation Commission  
P.O. Box 13087 - MC221  
Austin, TX 78711  
Phone: (512) 239-2498  
Fax: (512) 239-2449

**UTAH**

---

Tom Daniels  
Division of Solid and Hazardous Waste  
Department of Environmental Quality  
288 North 1460 West  
P.O. Box 144880  
Salt Lake City, UT 84114-4880  
Phone: (801) 536-4090  
Fax: (801) 536-4242

**VERMONT**

---

George Desch  
Sites Management Section  
Hazardous Materials Management  
VT Department of Environmental  
Conservation  
103 S. Main Street  
Waterbury, VT 05676  
Phone: (802) 241-3491  
Fax: (802) 244-1102

**VIRGINIA**

---

Erica Dameron  
Office of Superfund and Federal Facilities  
VA Department of Environmental Quality  
P.O. Box 10009  
629 E. Main Street, 10<sup>th</sup> Floor  
Richmond, VA 23219  
Phone: (804) 762-4201  
Fax: (804) 762-4262

**WASHINGTON**

---

Carol Kraege  
Headquarters Section - Policy and Technical  
Support  
Waste Management Programs - Toxics  
Cleanup  
WA Department of Ecology  
P.O. Box 47600  
Olympia, WA 98504-7600  
Phone: (360) 407-7175  
Fax: (360) 407-7154

**WEST VIRGINIA**

---

Pamela Hayes  
Site Investigation and Response Section  
Division of Environmental Protection  
Office of Waste Management  
WV Bureau of Environment  
1356 Hansford Street  
Charleston, WV 25301  
Phone: (304) 558-2745  
Fax: (304) 558-0256

**WISCONSIN**

---

Darsi Foss  
Division of Air and Waste Management  
Bureau for Remediation and Redevelopment  
WI Department of Natural Resources  
P.O. Box 7921  
Madison, WI 53707  
Phone: (608) 267-7562  
Fax: (608) 267-2768

Mark Giesfeldt  
Division of Air and Waste Management  
Bureau for Remediation and Redevelopment  
WI Department of Natural Resources  
P.O. Box 7921  
Madison, WI 53707  
Phone: (608) 267-6713  
Fax: (608) 267-2768

**WYOMING**

---

David Finley  
Solid and Hazardous Waste Division  
WY Department of Environmental  
Quality  
122 West, 25<sup>th</sup> Street  
Cheyenne, WY 82002  
Phone: (307) 777-7752  
Fax: (307) 777-5973

**EPA REGIONAL BROWNFIELDS COORDINATORS****REGION 1**

*Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*

John Podgurski  
U.S. EPA  
John F. Kennedy Federal Building  
One Congress Street  
Boston, MA 02203  
Phone: (617)573-9681  
Fax: (617)573-9662

**REGION 2**

*New Jersey, New York, Puerto Rico, Virgin Islands*

Larry D'Andrea  
U.S. EPA  
290 Broadway  
18<sup>th</sup> Floor  
New York, NY 10007  
Phone: (212)637-4314  
Fax: (212)637-4360

**REGION 3**

*Delaware, Washington, D.C., Maryland, Pennsylvania, Virginia, West Virginia*

Tom Stolle  
U.S. EPA  
841 Chestnut Building  
Philadelphia, PA 19107  
Phone: (215)566-3121  
Fax: (215)566-3001

**REGION 4**

*Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee*

Barbara Dick  
U.S. EPA  
Atlanta Federal Center  
100 Alabama Street, SW  
Atlanta, GA 30303  
Phone: (404)562-8923  
Fax: (404)562-8896

**REGION 5**

*Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin*

Mary Beth Tuohy  
U.S. EPA  
77 West Jackson Boulevard  
Chicago, IL 60604-3507  
Phone: (312)886-7596  
Fax: (312)886-2737

**REGION 6**

*Arkansas, Louisiana, New Mexico, Oklahoma, Texas*

Stan Hitt  
U.S. EPA  
First Interstate Bank Tower at  
Fountain Place  
1445 Ross Avenue, Suite 1200  
Dallas, TX 75202-2733  
Phone: (214)665-6736  
Fax: (214)665-6660

**REGION 7**

*Iowa, Kansas, Missouri, Nebraska*

Susan Klein  
U.S. EPA  
720 Minnesota Avenue  
Kansas City, KS 66101-2728  
Phone: (913)551-7786  
Fax: (913)551-7063

**REGION 8**

*Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming*

David Ostrander  
U.S. EPA  
999 18<sup>th</sup> Street, Suite 500 (EPR)  
Denver, CO 80202-2405  
Phone: (303)312-6931  
Fax: (303)312-6071

**REGION 9**

*Arizona, California, Hawaii, Nevada, American Samoa, Guam*

Jim Hanson  
U.S. EPA  
75 Hawthorne Street, H-1  
San Francisco, CA 94105  
Phone: (415)744-2237  
Fax: (415)744-2180

**REGION 10**

*Alaska, Idaho, Oregon, Washington*

Lori Cohen  
U.S. EPA  
1200 Sixth Avenue  
Seattle, WA 98101  
Phone: (206)553-6523  
Fax: (206)553-0124

**EPA HEADQUARTERS**

Katherine Dawes  
Outreach and Special Projects Staff  
Office of Solid Waste  
and Emergency Response  
U.S. EPA  
401 M Street, SW (MC5101)  
Washington, DC 20460  
Phone: (202)260-8394  
Fax: (202)260-6606

## EPA TECHNICAL SUPPORT

### GENERAL INFORMATION: TECHNOLOGY INNOVATION OFFICE

#### CLEANUP TECHNOLOGIES

John Kingscott  
Technology Innovation Office  
U.S. EPA  
401 M Street, SW (MC 5102G)  
Washington, DC 20460  
Phone: (703)603-7189  
Fax: (703)603-9135  
E-mail: [kingscott.john@epamail.epa.gov](mailto:kingscott.john@epamail.epa.gov)

#### ELECTRONIC INFORMATION

Gary Turner  
Technology Innovation Office  
U.S. EPA  
401 M Street, SW (MC 5102G)  
Washington, DC 20460  
Phone: (703)603-9902  
Fax: (703)603-9135  
E-mail: [turner.gary@epamail.epa.gov](mailto:turner.gary@epamail.epa.gov)

#### GROUNDWATER INFORMATION

Richard Steimle  
Technology Innovation Office  
U.S. EPA  
401 M Street, SW (MC 5102G)  
Washington, DC 20460  
Phone: (703)603-7195  
Fax: (703)603-9135  
E-mail: [steimle.richard@epamail.epa.gov](mailto:steimle.richard@epamail.epa.gov)

#### REGULATORY INFORMATION

Jim Cummings  
Technology Innovation Office  
U.S. EPA  
401 M Street, SW (MC 5102G)  
Washington, DC 20460  
Phone: (703)603-7197  
Fax: (703)603-9135  
E-mail: [cummings.james@epamail.epa.gov](mailto:cummings.james@epamail.epa.gov)

#### SITE CHARACTERIZATION AND MONITORING

Daniel Powell  
U.S. EPA  
Technology Innovation Office  
401 M Street, SW (MC 5102G)  
Washington, DC 20460  
Phone: (703)603-7196  
Fax: (703)603-9135  
E-mail: [powell.dan@epamail.epa.gov](mailto:powell.dan@epamail.epa.gov)

### SPECIFIC TECHNICAL SUPPORT: OFFICE OF RESEARCH AND DEVELOPMENT

#### CLEANUP TECHNOLOGIES

Ed Barth  
National Risk Management Research  
Laboratory (NRMRL)  
Office of Research and Development  
U.S. EPA  
26 Martin Luther King Drive  
Cincinnati, OH 45268  
Phone: (513)569-7669  
Fax: (513)569-7676  
E-mail: [barth.ed@epamail.epa.gov](mailto:barth.ed@epamail.epa.gov)

Joan Colson  
National Risk Management Research  
Laboratory (NRMRL)  
Office of Research and Development  
U.S. EPA  
26 Martin Luther King Drive  
Cincinnati, OH 45268  
Phone: (513)569-7501  
Fax: (513)569-7676

#### SITE CHARACTERIZATION TECHNOLOGIES

Eric Koglin  
National Exposure Research  
Laboratory (NERL)  
Office of Research and Development  
U.S. EPA  
P.O. Box 93478  
Las Vegas, NE 89193-3478  
Phone: (702)798-2432  
Fax: (702)798-2261  
E-mail: [koglin.eric@epamail.epa.gov](mailto:koglin.eric@epamail.epa.gov)

This page intentionally left blank.

---

# **APPENDIX E**



## Appendix E

# HOW TO ORDER DOCUMENTS

---

Publications beginning with EPA number **540, 542, 600, 625, or 630** may be available through the Center for Environmental Research Information (CERI). The documents are available free-of-charge, but supplies may be limited. Documents that are not in stock at CERI may be available through the National Center for Environmental Publications and Information (NCEPI) or may be purchased from the National Technical Information Service (NTIS). Before you purchase documents, you may wish to contact a technical librarian to determine whether the document you need is available at no charge. Be sure to include the EPA document number with all orders.

Publications beginning with EPA number **510, 540, 542, 600, or 630** may be available through NCEPI. Single copies are available free-of-charge while supplies last. Documents that are out of stock must be ordered from NTIS. Be sure to include the EPA document number with all orders.

Publications beginning with **PB numbers or directives** (for parties outside EPA) issued by EPA's Office of Solid Waste and Emergency Response (OSWER) can be purchased from NTIS. Be sure to include the EPA document number with all orders.

Publications of the **WASTECH** partnership may be ordered by contacting the American Academy of Environmental Engineers at 410-266-3390.

EPA staff or members of the public who have difficulty finding a document can call the Resource Conservation and Recovery Act (RCRA)/Underground Storage Tank (UST), Superfund, and Emergency Planning and Community Right-to-Know Act (EPCRA) Hotline at 1-800-424-9346 for all nongovernment locations outside the Washington, DC Metropolitan local calling area, or 703-412-9810 for all locations in the Washington, DC metropolitan local calling area. The hotline operates daily Monday through Friday, 9:00 a.m. through 6:00 p.m., eastern standard time. Hotline staff can help callers locate documents and assist them in placing orders. Government employees may order many of the documents that have EPA publication numbers free of charge from NCEPI.

The addresses and telephone and facsimile numbers for the services are listed below:

**CERI**     *Center for Environmental Research  
Information*  
U.S. EPA  
26 West Martin Luther King Drive  
Cincinnati, OH 45268  
Telephone: (513)569-7562  
Fax: (513)569-7566

**NTIS**     *National Technical Information  
Service*  
5285 Port Royal Road  
Springfield, VA 22161  
Telephone: (703)487-4650  
Fax: Not applicable  
Internet E-mail: [orders@ntis.fedworld.gov](mailto:orders@ntis.fedworld.gov)

**NCEPI**     *National Center for Environmental  
Publications and Information*  
U.S. EPA  
P.O. Box 42419  
Cincinnati, OH 45242  
Telephone: (513)489-8190  
Fax: (513)489-8695

This page intentionally left blank.

# CENTER FOR ENVIRONMENTAL RESEARCH INFORMATION ORDER FORM

Publications beginning with EPA number 540, 542, 600, 625 or 630 may be available through the Center for Environmental Research Information (CERI). The documents are available free of charge, but supplies may be limited.

**Mail to:**       **Center for Environmental Research Information**  
                  **U.S. Environmental Protection Agency**  
                  **26 West Martin Luther King Drive**  
                  **Cincinnati, OH 45628**  
                  **(513) 569-7562**

**Fax to:**       **(513) 569-7566**

---

Document No.	Document Title	Quantity
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>

---

## Customer Information

---

Name

---

Company

---

Street Address

---

City

State

Zip Code

---

Daytime Telephone Number

FOLD HERE

---

Return Address:

**Place  
Stamp  
Here**

Center for Environmental Research Information  
U.S. Environmental Protection Agency  
26 West Martin Luther King Drive  
Cincinnati, OH 45628

---

FOLD HERE

# NATIONAL CENTER FOR ENVIRONMENTAL PUBLICATIONS AND INFORMATION ORDER FORM

Publications beginning with EPA number 510, 540, 542, 600, 625 or 630 may be available through the National Center for Environmental Publications and Information (NCEPI). Single copies are available free of charge while supplies last.

**Mail to:**        **National Center for Environmental Publications and Information**  
                  **U.S. Environmental Protection Agency**  
                  **P.O. Box 42419**  
                  **Cincinnati, OH 45242**  
                  **(513) 489-8190**

**Fax to:**        **(513) 489-8695**

---

Document No.	Document Title	Quantity
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>

---

## Customer Information

---

Name

---

Company

---

Street Address

---

City

State

Zip Code

---

Daytime Telephone Number

FOLD HERE

---

Return Address:

**Place  
Stamp  
Here**

National Center for Environmental Publications and Information  
U.S. Environmental Protection Agency  
P.O. Box 42419  
Cincinnati, OH 45252

---

FOLD HERE

FOLD HERE

---

Return Address:

**Place  
Stamp  
Here**

Center for Environmental Research Information  
U.S. Environmental Protection Agency  
26 West Martin Luther King Drive  
Cincinnati, OH 45628

---

FOLD HERE

**Mail to: American Academy of Environmental Engineers  
130 Holiday Court, Suite 100  
Annapolis, MD 21401  
(410) 266-3390**

---



PLEASE PRINT OR TYPE

## SHIP TO ADDRESS

CITY/STATE/ZIP+4 (Required for delivery)		SALE
ATTENTION/NAME		
ORGANIZATION		DIVISION/ROOM/NUMBER
STREET ADDRESS		
CITY	STATE	ZIP+4
TECHNICAL INFORMATION		INTERNET/E-MAIL ADDRESS
COUNTRY		
PHONE NUMBER ( )	FAX NUMBER ( )	
CREDIT CARD		INTERNET/E-MAIL ADDRESS

## METHOD OF PAYMENT

<input type="checkbox"/> VISA	<input type="checkbox"/> MasterCard	<input type="checkbox"/> American Express
CREDIT CARD NUMBER		EXPIRATION DATE
CARDHOLDER'S NAME		
<input type="checkbox"/> NTIS Deposit Account Number:		
<input type="checkbox"/> Check / Money Order enclosed for \$		(PAYABLE IN U.S. DOLLARS)
SPENDING LIMIT - PERIOD (If you wish to set a limit)		

**ORDER BY PHONE** (For direct mail, fax)  
8:30 a.m. - 5:30 p.m. Eastern Time, M - F.  
Sales Desk: (703) 487-4660  
TDD (hearing impaired only): (703) 487-4660

**ORDER BY FAX**  
24 hours/7 days a week: (703) 321-8547  
To verify receipt of fax: call (703) 487-4660  
7:00 a.m. - 5:00 p.m., Eastern Time, M - F.

**ORDER BY MAIL**  
National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161

**RUSH SERVICE** (For direct mail, fax, or phone)  
1-800-553-NITIS. RUSH service available for additional fee.

**ONLINE ORDERING**  
Order through the internet: 24 hours a day: orders@ntis.ed.gov  
If concerned about Internet security, you may register your credit card at NTIS. Simply call (703) 487-4660.

**FEEDBACK**  
Please call for comment information: (703) 487-4722

**BILL ME**  
(U.S., Canada, and Mexico only)  
**DO NOT USE THIS FORM.**

NTIS will gladly bill your order, for an additional fee of \$7.50.  
A request to be billed must be on a purchase order or company letterhead. An authorizing signature, contact name, and telephone number should be included with this request. Requests may be mailed or faxed.

**REFUND POLICY**  
Although NTIS cannot accept returns for credit or refund, we will gladly replace any item you requested if we made an error in filling your order. If the item was defective, or if you received it in damaged condition, just call our Customer Service Department at (703) 487-4660.

## NTIS HANDLING FEE

Value of Order	Handling Fee
\$10.00 or less	\$2.00
\$10.01 - \$50.00	\$4.00
\$50.01 - \$100.00	\$6.00
Over \$100.00	\$8.00

Add \$2.00 to handling fee for orders sent outside the United States, Canada, and Mexico.

PLEASE PRINT OR TYPE

## PRODUCT SELECTION

NTIS PRODUCT NUMBER (Including by title alone will display your order)	MINIMUM CHARACTER ROUTING (OPTIONAL) UP TO 10 CHARACTERS	UNIT PRICE	QUANTITY				INTERNATIONAL AIRMAIL *** (SEE BELOW)	TOTAL PRICE
			PAPER COPY	WEEKLY MICRO	ANNUAL INDEX	OTHER		
LOG		\$					\$	\$
LOG		\$					\$	\$
LOG		\$					\$	\$
LOG		\$					\$	\$
LOG		\$					\$	\$

* CIRCLE REQUIREMENTS	3-5C CARTRIDGE	1-200 API	6250 API	LABELLING STANDARD	NON-LABELLED	FORMAT BIBLIO	ASCI
-----------------------	-------------------	--------------	-------------	-----------------------	--------------	------------------	------

### PLEASE NOTE

Unless microfilm or other is specified, paper copy will be sent.

Please call the Sales Desk at (703) 487-4660 for information on multiple copy discounts available for certain documents and price verification.

### Out-Of-Print Surcharge

Effective 4/1/95, an out-of-print surcharge may apply to certain files acquired by NTIS more than three years prior to the current calendar year. Please call to verify price.

### International Airmail Fees

Canada and Mexico add \$4 per paper copy report; \$1 per microfilm copy. Other countries add \$6 per paper copy report; \$1.25 per microfilm copy. (Paper copy reports and microfilm copies are shipped surface mail unless airmail is specified.)

TOTAL \$

HANDLING FEE PER ORDER \$

INTERNATIONAL AIRMAIL \$

GRAND TOTAL \$

*Thank you for your order!*  
Prices are subject to change.

All previous versions of this form are obsolete.  
0190